LEPTOCEPHALUS OF THE ATLANTIC TARPON, *MEGALOPS ATLANTICUS* VALENCIENNES, FROM OFFSHORE WATERS

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Plankton samples were collected as part of the routine biological observations made during cruises of the M/V *Theodore N. Gill* off the south Atlantic coast of the United States during the years 1953 and 1954. The cruises constituted the initial or collecting phase of the U. S. Fish and Wildlife Service's biological, chemical, and oceanographic inventory of the waters from Cape Hatteras, North Carolina to the Straits of Florida from the coast out to beyond the approximate axis of the Gulf Stream. During the examination of fish larvae taken in the plankton tows, in particular the search for leptocephalid larvae of the ten-pounder, *Elops saurus* Linnaeus, one leptocephalid form was found that resembled the ten-pounder larvae in general form (ribbonlike with flattened, triangular head and forked caudal fin), but differed in numbers of dorsal and anal rays (ray bases), and body myomeres. This leptocephalus, 18.0 mm. in standard length, was taken in an oblique tow (65 meters to surface) with a half-meter plankton net at 1225-1249 hours on August 5, 1953, at Regular Station 40 of *T. N. Gill* cruise 3, 31°30′ N. lat., 78°42′ W. long., about 150 miles east and slightly north of Brunswick, Georgia, and well out in the Gulf Stream.

The unusual larval development of the tarpon, the ten-pounder, and the bonefish *Albula vulpes* (Linnaeus), requires special terminology to distinguish the developmental stages since there are two periods of length increase separated by a period of length decrease (the beginning of metamorphosis). I have restricted the term *leptocephalus* to a larva in its initial stage of length increase, up to the size at which shrinking begins; while the term *metamorphic larva* is suggested for a larva undergoing shrinking, during metamorphosis, and subsequent length increase to the juvenile stage (Gehringer, *in press*).

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Whereas the leptocephalus of the ten-pounder has (at the apparent stage of development of the larva in question) 14 to 16 dorsal ray bases and 6 to 8 anal ray bases (Gehringer, *in press*), this leptocephalus has 12 dorsal ray bases and 21 anal ray bases. There are 55-57 myomeres (last 2 or 3 indistinct), whereas the ten-pounder generally has in excess of 75 myomeres. During metamorphosis the ten-pounder develops 21 to 26 dorsal rays (adult complement, 25 to 29) and 12 to 18 anal rays (adult complement, 16 to 19). While it is possible that the number of dorsal ray bases might have increased on the leptocephalus in question during and following metamorphosis, it is not possible for the number of anal rays to decrease, nor for the number of body myomeres to increase to the range for the ten-pounder. The number of anal rays for the bonefish, *A. vulpes,* is 8 or 9 (Hildebrand, 1943), eliminating this species from consideration.

Hildebrand (1934) described a specimen "in transition from the leptocephalid to the adult form" of the Atlantic tarpon, *Megalops atlanticus* Valenciennes,[2] taken in the mouth of Core Creek, Beaufort, North Carolina, August 21, 1929, 20 mm. in total length, with 52 body myomeres, 12 dorsal rays, and 20 anal rays, all distinct. The specimen unfortunately was inadvertently destroyed. Harrington (1958) described a collection of 259 "young" Atlantic tarpon from 16.0 mm. in standard length (18.8 mm. total length) to about 54 mm. in standard length (69.0 mm. total length), bridging the gap between the smallest previously described "post-larval" sizes of Hildebrand's 20-mm. transitional larva and a "post larva" of 42 mm. in standard length described by Breder (1944). Hildebrand's 20-mm. specimen, and Harrington's 18.8-mm. "young" were in a much more advanced stage than my specimen; that is, well-developed dorsal and anal rays were present and pelvic fins were present in their specimens, and Harrington describes the air bladder of his 18.8-mm. larva as of "considerable" size, indicating they had undergone the initial growth of the leptocephalus and shrunk to the size at which subsequent growth begins. The ray and myomere counts leave little doubt that my larva is a tarpon, disregarding the ever-present possibility that some other fish has an undescribed

[2] Following Bailey's review (1951) of the authorship of names proposed in Cuvier and Valenciennes' Histoire Naturelle des Poissons.

developmental history which could be confused with that of the tarpon.

Leptocephali of the ten-pounder reach a length of 40-45 mm. S. L. before beginning to shrink during metamorphosis, and shrink to about 20 mm. S. L. before length begins to increase again. Comparison of the leptocephalus in question with ten-pounder leptocephali of similar size, and comparable stage of development, shows a remarkable similarity in general form. Comparison of Harrington's figure 5 of his 16.0-mm. S. L. transitional stage of the tarpon with my 24.7-mm. S. L. mid-metamorphic larva of the ten-pounder (Gehringer, *in press*) also shows a superficial similarity. Comparison of these specimens and figures convinces me that, as with the offshore leptocephali of the ten-pounder, we have fortunately found an offshore leptocephalus of the tarpon. The length the leptocephalus of the Atlantic tarpon attains before beginning to shrink is unknown, but the East Indian tarpon, *Megalops cyprinoides* (Broussonet), was reported by Chidambaram and Menon (1948) as shrinking from about 30 mm. down to 17 mm. during metamorphosis, in laboratory experiments. Alikunhi and Rao (1951) reported *M. cyprinoides* leptocephali of 28 to 30 mm. shrank to as small as 16.5 mm. during metamorphosis, also in laboratory experiments. They cite a report by Bal and Pradhan (1947) of metamorphosing larvae of *M. cyprinoides* 13.5 mm. long. It is reasonable to assume that my leptocephalus would have had to increase in length and development before shrinking to the size and stage of development exhibited by Hildebrand's and Harrington's metamorphic larvae.

Van Kampen (1908, 1928) figured a 25-mm. total length (22 mm. "without caudal") *M. cyprinoides*, showing well-developed fin rays, an air bladder, and rudimentary pelvic fins. This is reputed to be the first published illustration of a tarpon "leptocephalus." Delsman's (1926) figure of a 29-mm. total length (about 26.5 mm. in S. L.) *M. cyprinoides* also shows a developing air bladder, pelvic fins; but with *all* rays of dorsal, anal, and caudal fins branched (this is considered an inaccuracy of the illustrator). Figured in the Bulletin of the International Oceanographic Foundation (Anonymous 1955) is the "leptocephalus" of the Atlantic tarpon, *M. atlanticus* (no size given), having well-developed dorsal, anal, and caudal fins, with pelvics also present. Holstvoogd (1936) figures a

series of metamorphosing *M. cyprinoides* in which the earliest stage larva, about 20 mm. S. L., has a well-developed air bladder. I believe my specimen to be in the initial stage of length increase because it does not exhibit the development evidenced in these various larvae (metamorphic larvae by my definition).

The Marine Laboratory of the University of Miami collected eggs suspected of being those of the Atlantic tarpon, *M. atlanticus*, and maintained them through hatching and to larvae of 3.45 mm. standard length, or about 48 hours beyond time of hatching, before they died (Ellis, 1956)—duplicating earlier experiments by Breder (1944), whose larvae reached 2.9 mm. at 43 hours, but which shrunk to 1.9 mm. at 72 hours before dying (shrinkage is not explained). There have been no successful attempts to carry the egg through to a leptocephalus identifiable as that of the tarpon. Ellis (1956) speculated that after hatching the tarpon leptocephalus may move offshore with the currents and spend its early life as an open-ocean planktonic form. The leptocephalus taken on the *Gill* cruise lends evidence to this speculation.

Description of Preserved Specimen

Figure 1

Head: Triangular in dorsal aspect and compressed dorso-ventrally, wider than body, translucent with brain clearly visible; nostrils, shallow depressions; eyes large and oval; teeth, one fang-like tooth anteriorly on each side of upper jaw larger than remaining 4 in upper jaw and 5 in lower jaw.

Body: Uniformly thin, deep (ribbonlike), translucent with 55-57 body myomeres easily discernible with transmitted light (last few in caudal are indistinct); central nerve cord visible; vertebrae developing in caudal portion; digestive tract a tube appended to ventral margin of myomeres, anus opposite 41st myomere; air bladder a slight dorsal swelling in digestive tract at 23rd myomere; kidney dorsal to digestive tract at 35th to 41st myomeres.

Fins: Dorsal and anal finfold frayed with only ray bases formed, 12 dorsal and 21 anal, dorsal ray bases opposite 39th to 42nd myomeres and anal bases opposite 42nd to 48th myomeres, predorsal finfold small (fig. 1); caudal fin with 10 + 9 principal rays and 1 ventral secondary ray (none branched), hypural plates discernible

with transmitted light, urostyle prominent; some finfold at caudal peduncle, but no preanal finfold as is found in *Elops saurus* (Gehringer, *in press*); pectoral fin a rounded bud with no rays developed; no pelvic fin.

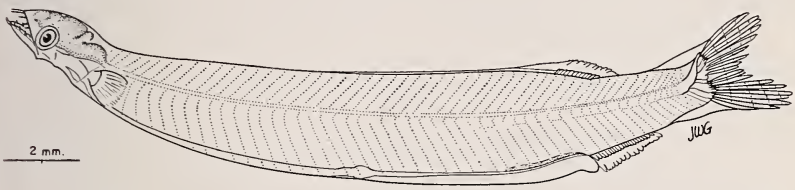

Figure 1. Leptocephalus of the Atlantic tarpon, *Megalops atlanticus* Valenciennes, 18.0 mm. in standard length.

Selected measurements: All measurements were made with aid of binocular microscope and micrometer eyepiece: Standard length, 18.0 mm.; total length, 19.7 mm.; head length, 2.40 mm.; length of lower jaw, 1.43 mm.; eye diameter (horizontal), 0.38 mm.; distance from snout to dorsal fin (anterior ray base), 13.1 mm.; distance from snout to anal fin (anterior ray base), 13.8 mm.; depth of head (at angle of jaw), 1.18 mm.; body depth at pectoral fin, 1.27 mm.; body depth at air bladder, 2.54 mm.; length of anal base, 1.56 mm.; length of dorsal base, 1.14 mm.

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Literature Cited

ALIKUNHI, K. H., and S. NAGARAJA RAO.
1951. Notes on the metamorphosis of *Elops saurus* Linn. and *Megalops cyprinoides* (Broussonet) with observations on their growth. *Journal of the Zoological Society of India,* 3(1): 99-109, 2 text-figs.

ANONYMOUS
1955. Opening the door to discovery. *Bulletin of the International Oceanographic Foundation,* 1(3): 44-47.

BAILEY, REEVE M.
1951. The authorship of names proposed in Cuvier and Valenciennes' Histoire Naturelle des Poissons. *Copeia,* 1951(3): 249-251.

BAL, D. V., and L. B. PRADHAN.
1947. Investigation of fish eggs and larvae from Bombay waters; Third Progress Report; 1946-47. *Department of Zoology Royal Institute of Science,* Bombay. [not seen]

BREDER, C. M., JR.
1944. Materials for the study of the life history of *Tarpon atlanticus*. *Zoologica*, 29(19): 217-252, text-figs. 1-9.

CHIDAMBARAM, K., and M. DEVIDAS MENON.
1948. Notes on the development of *Megalops cyprinoides* and *Hemirhamphus georgii*. *Proceedings of the Zoological Society of London*, 117: 756-763, figs. 1-9.

DELSMAN, H. C.
1926. Fish eggs and larvae from the Java Sea (10. On a few larvae of empang fishes). *Treubia*, 8(3-4): 400-412, 17 figs.

ELLIS, ROBERT W.
1956. Tarpon cooperative research program progress report. Report to Florida State Board of Conservation by The Marine Laboratory, University of Miami, July, 1956, 13 pp. (mimeographed).

GEHRINGER, JACK W.
In press
Early development and metamorphosis of the ten-pounder, *Elops saurus* Linnaeus. U. S. Fish and Wildlife Service, *Fishery Bulletin*.

HARRINGTON, ROBERT W., JR.
1958. Morphometry and ecology of small tarpon, *Megalops atlantica* Valenciennes from the transitional stage through onset of scale formation. *Copeia*, 1958(1): 1-10, 5 figs., 2 pls.

HILDEBRAND, SAMUEL F.
1934. The capture of a young tarpon, *Tarpon atlanticus*, at Beaufort, North Carolina. *Copeia*, 1934(1): 45-46.
1943. Notes on the affinity, anatomy, and development of *Elops saurus* Linnaeus. *Jour. Wash. Acad. Sci.*, 33(3): 90-94, figs. 1-3.

HOLSTVOOGD, C.
1936. The development of the mesonephros in some teleosts. Proefschrift, Universiteit van Amsterdam. Meijer's Boek—en Handelsdrukkerij—Wormerveer, xvi+98 pp., 14 figs., 35 photographs.

VAN KAMPEN, P. N.
1908. Die larve von *Megalops cyprinoides* Brouss. *Bulletin du Department De l'Agriculture aux Indees Neerlandaises*, No. 20, pp. 10-12, 1 fig.
1928. The larva of the East Indian tarpon, *Megalops cyprinoides* Brouss. [Translation of 1908 publication, from *Beneath Tropical Seas* by William Beebe, G. P. Putnam's Sons, New York-London, pp. 228-229]